Storm damage on Black Rock Sea Wall, April 2009

Eric Bird

Geostudies, Australia, 343 Beach Road, Black Rock, Victoria 3193

Abstract

In recent years episodes of storm damage to the sea wall at Black Rock have occurred in April and May, when the adjacent sandy beach has disappeared because of northward longshore drifting during the previous summer. Southward drifting from April to November then restores a protective beach in front of the sea wall. Damage is likely to recur in April and May unless a beach can be artificially maintained in front of the sea wall. (*The Victorian Naturalist* **127** (5) 2010, 196-200).

Keywords: storm damage, sea wall, longshore drift, beach erosion

Introduction

The north-east coast of Port Phillip Bay consists of alternating headlands and sandy bays. The coastal geology consists of a soft pale clayey sandstone, the Red Bluff Sand, over a harder dark brown ferruginous sandrock, the Black Rock Sandstone, both well exposed in Red Bluff (Kenley 1967). The contact between the Red Bluff Sand and the Black Rock Sandstone undulates gently: it protrudes on headlands with rocky shore ledges where it is slightly above mean sea level at Black Rock Point and Quiet Corner, and it is a little below mean sea level along Black Rock Beach, where the dark sandrock is partly exposed at low tide.

Headlands divide this coast into several natural beach compartments, in each of which sand drifts northward during the summer half-year from November to April (Fig. 1), and southward during the winter half year from May to October (Fig. 2). Black Rock Beach, extending from Black Rock Point south to Quiet Corner, is one of these. By late summer the northern half of the beach has widened, while the southern half is much reduced, and has an extensive beach-less sector (Fig. 1). During the winter half-year, sand drifts southward, so that the northern half of the beach is narrower, and the southern half has a beach extending in front of the sea wall towards Quiet Corner.

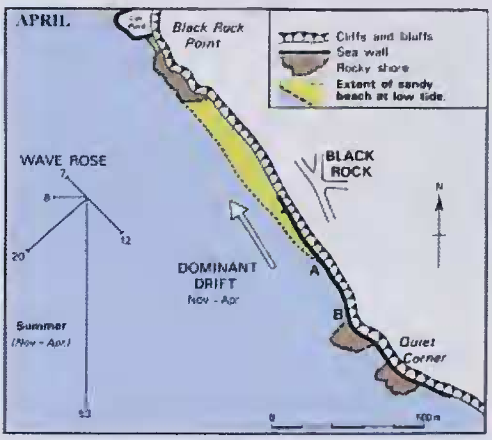

Fig. 1. Black Rock Beach at the end of summer (April) after six months of dominant northward drifting. AB is the sector of sea wall that was not beach-fringed, and was thus damaged during the storm of 25–26 April 2009.

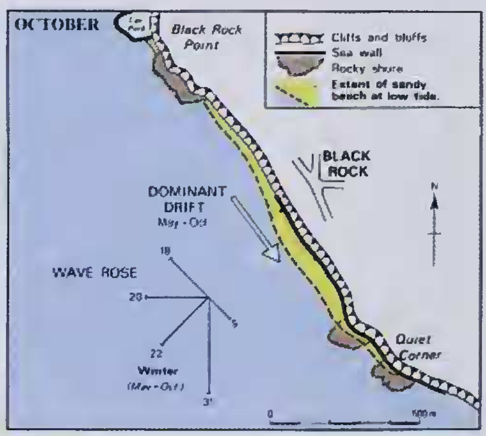

Fig. 2. Black Rock Beach at the end of winter (October) after six months of dominant southward drifting has established a protective beach in front of the sea wall.

The extent of seasonal drifting has varied from year to year. In April 2000, northward drifting during the summer had been so pronounced that the beach disappeared along the whole length of the sea wall and became exceptionally low and narrow in the central sector, near the Black Rock Life Saving Club. In most years a short sector of beach persists in late summer below the Black Rock car park, but invariably it disappears from the sea wall sector between A and B in Fig. 1, which is then exposed to wave attack.

The northern half of Black Rock Beach stands in front of a scrub-covered bluff which was formerly a receding cliff cut in soft Red Bluff Sand, while the southern half was an active, receding cliff when the first European settlers came here in the 19th century. The contrast is probably related to the evolution of the beach system, with a perennial beach of varying width in the northern half, and seasonal exposure to wave action along the southern half, where the cliff was unprotected by a fringing beach for several months each summer.

It has been suggested that cliffs were more extensive around Port Phillip Bay during the early Holocene, between 6000 and 4000 years ago, when sea level was slightly higher than it is now, and that a subsequent fall in sea level (which promoted beach accretion) resulted in their being reduced to steep, vegetated slopes. Cliffs persisted only on exposed sectors, notably headlands (Bird 1993).

A storm surge on 29–30 November 1934 caused extensive erosion along the east coast of Port Phillip Bay, and in the following year the state government set up a Foreshore Erosion Board, which surveyed sectors where erosion had been rapid (Mackenzie 1939). It was decided that sea walls should be built to protect the most vulnerable sectors, including one extending from Black Rock south to beyond Quiet Corner. This was constructed between 1936 and 1939, and took the form of a masonry wall and undercliff walk, the backing cliff being graded to a 30° slope and planted with grasses and shrubs.

Fig. 3. Waves breaking over the sea wall at Quiet Corner on 26 April 2009.

Fig. 4. The 26 April 2009 storm had little effect on the sandy beach north of Black Rock. Seaweed litter marks the limit of storm swash on that day.

The storm of 25-26 April 2009

A deep depression passed across southern Victoria on 25–26 April 2009, generating a southwesterly gale over Port Phillip Bay. For several hours, waves up to 2.5 m high broke heavily on the shore between Black Rock Point and Quiet Corner (Fig. 3). In the northern half of the Black Rock beach compartment the waves broke on the seaward margin of the wide sandy beach and had little effect, the wave energy being absorbed by the sandy beach (Fig. 4). In the southern half a long sector of the sea wall (AB in Fig. 1) had no protective beach, and this is why the waves caused such severe damage (Fig. 5). Within a few days, southward drifting of sand began to build a beach in front of the damaged sea wall. By the end of May the sea wall was bordered by a narrow protective beach, and during the winter this became wider, until in November the wall was well protected (Fig. 6). Bayside Council decided to repair the sea wall and restore the features that existed prior to the storm, and this work was completed on 20 November.

The storm damage on 25–26 April 2009 was not unprecedented. There had previously been several episodes of storm damage, particularly in April and May, the time when there is little or no beach in front of the sea wall. The storm of 30 April 1986 inflicted similar damage (Fig. 7). The

Fig. 5. Damaged sea wall south of Black Rock, 27 April 2009.

Fig. 6. Protective beach in front of sea wall south of Black Rock, November 2009.

repaired sea wall between A and B on Fig. 1 is still vulnerable to storm damage in early winter, before drifting sand arrives to build a protective beach in front of it.

Sea wall protection

One way of protecting this sea wall would be to dump large boulders in front of it, but this would cause wave reflection and prevent beach accretion (as it did on the Hampton shore in the 1970s). An alternative would be to build an offshore breakwater parallel to the coastline and about 30 m seaward. This would protect the sea wall from storm wave attack and also induce beach accretion along the sea wall, shaped by waves refracted round its ends. Either of these measures would be criticised as introducing unsightly structures to the shore.

Another way of preventing damage to this sea wall would be to form and maintain a protective beach in front of it all year round. When the sea wall was originally constructed, a series of wooden groynes was built, protruding about 20 metres seaward, in the hope of trapping sand and retaining a protective beach, but they were not effective, and soon deteriorated. Only minor remnants can now be seen, for example just north of Quiet Corner.

A previous attempt was made in December 1969 to maintain this beach by dumping numerous lorry-loads of sand in front of the sea wall (Fig. 8), but it all drifted away to the north during the following summer. It might be possible to maintain a beach here by dumping a very large quantity of sand (of the order of 200 000 m^3), but there then would be losses northward (round Black Rock Point) when the beach became very wide in late summer, and southward (round Quiet Corner) when it widened at the southern end in late winter. In due course these losses would deplete the beach, and after a few years the sea wall between A and B would be again exposed to storm waves. An alternative would be frequent renourishment of the AB sector with sand pumped or ferried from the northern end of the beach, but this would be expensive, and such perennial recycling is unlikely to be maintained.

It would be possible to stop sand drifting away northward from the southern half of Black Rock Beach each summer by building large stone groynes at A and B to enclose a compartment containing deposited beach sand (Bird 1990). Such groynes have been successful in retaining artificial beaches at Hampton, and have been introduced (despite some local opposition) on Sandringham beach. It is likely that they would prove successful in maintaining a beach and ensuring stability of the sea wall between Black Rock and Quiet Corner.

Fig. 7. Damage to sea wall by a previous storm, 30 April 1986.

Fig. 8. Sand dumped on the shore near Quiet Corner, December 1969. It drifted away to the north during the next four months, and did not provide winter protection for the sea wall.

This analysis of the storm damage to the Black Rock sea wall illustrates the need for coastal managers and engineers to be aware of geomorphological processes.

References

Bird ECF (1990) Artificial beach nourishment on the shores of Port Phillip Bay. *Journal of Coastal Research*, Special Issue **6**, 55–68.

Bird ECF (1993) *The Coast of Victoria*. (Melbourne University Press: Melbourne)

Kenley PR (1967) Tertiary. In *Geology of the Melbourne District, Victoria*, pp. 31–46. Geological Survey of Victoria, Bulletin No. 59.

Mackenzie AD (1939) Coastal erosion in Victoria. *Transactions of the Institute of Engineers of Australia* **20**, 229–236.

Received 3 December 2009; accepted 11 May 2010

One hundred years ago

SANCTUARIES FOR SEABIRDS

By a recent *Gazette* notice the Tasmanian Government has proclaimed Foster and Albatross Islands as sanctuaries for sea-birds. The former is situated in Banks Strait, off the north-east coast of Tasmania, and is the resort of Pelicans and Cape Barren Geese; while Albatross Island, off the north-west corner of Tasmania, is the breeding place of the Sooty Albatross and other birds. Cat and Storehouse Islands, portion of the Flinders Group, on which there are extensive rookeries of gulls, gannets, penguins, and muttonbirds have also been reserved, so that our sea-birds should now receive some measure of protection, and naturalists should be deeply indebted to the Tasmanian Government for its action.

From *The Victorian Naturalist* **XXVII**, p. 30, June 9, 1910